

Agricultural Research Institute, Pusa

MEMORANDUM ON INDIAN WHEAT
FOR THE BRITISH MARKET

(*Read before the Incorporated National Association of
British and Irish Millers*)

BY

SIR JAMES WILSON, K.C.S.I.,
Late Financial Commissioner, Punjab.

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PREFATORY NOTE.

I HAVE written this paper with the object of doing what I can to encourage the trade in wheat between India and the United Kingdom, mainly in the interest of the India producer, whose welfare has been my chief concern during many years' service in India. I believe, however, that an improvement in the trade will be of advantage to all concerned in it, whether as producers, merchants, shipowners, millers, or consumers; and possibly some of the facts I have gathered and of the suggestions I venture to make may be of interest to the British miller. I am greatly indebted to a number of gentlemen who have kindly supplied me with information on the subject, but I am myself entirely responsible for the statements made, whether of fact or opinion. They are binding on no one else, and I myself may see reason to modify them on further study of the subject.

MEMORANDUM ON INDIAN WHEAT FOR THE BRITISH MARKET.

Import of Indian Wheat into Britain.

THERE has been a rapid development of the Indian wheat trade with the United Kingdom within the last seven years. For the ten years ending 1902 the total imports of wheat and wheat-flour into the United Kingdom from all countries averaged 99 million cwt. per annum, and the imports from India averaged 5 million cwt. That is, on the average, India supplied this country with only 5 per cent. of its total requirements of wheat from abroad. The largest import from India in any year of that period was 9½ million cwt. in 1898, which equalled 10 per cent. of Britain's total imports for that year, and in each of the two years 1897 and 1900, which were years of famine in India, the imports of Indian wheat into the United Kingdom were of negligible quantity, only 600,000 cwt. in the former year and 6,000 cwt. in the latter.

It will be seen from Table I that for the last seven years the imports of wheat into the United Kingdom from abroad averaged 114 million cwt. as compared with 99 million in the previous ten-year period, and that the countries chiefly contributing to that total were, in order:—The United States, 27 per cent.; the Argentine Republic, 19 per cent.; India and Russia, 14 per cent. each; Canada, 12 per cent.; and Australia, 7 per cent. It is interesting to note that, as compared with the average of the three years ending 1902, the contribution of the United States has fallen from 62 to 27 per cent. of the total, while the Argentine's share has risen from 10 to 19 per cent., Canada's from 9 to 12, Australia's from 4 to 7, and India's and Russia's have each risen from 4 to 14 per cent.

Confining attention to India, it will be seen that the imports from that country into the United Kingdom, which averaged only 5 million cwt. for the ten years ending 1902, have averaged 16 million cwt. in the last seven years. In the very good year, 1901, they exceeded 25 million cwt., and, on the other hand, in 1908, which was a year of serious and widespread drought in northern

India, they dwindled to only 3 million. The fact that on the average of the last seven years Britain has obtained from India one-seventh of her total requirements of wheat from abroad, shows how important the Indian wheat trade is to the British consumer, and, therefore, to the British miller and merchant.

Among the reasons for the great increase in the import from India in the last seven years compared with the previous ten, are the decrease in the surplus available from the United States, the gradual extension of cultivation and irrigation in India, the fact that the seasons have on the whole been much more favourable in northern India since 1903 than they were for the eight years after 1891, the rapid improvement in communications by ship, railway, and road, and the steadyng of the gold value of the rupee, which has been maintained at a uniform rate of sixteenpence since 1898, while before that date it fluctuated from year to year in a manner most disconcerting to all trade calculations.

Export of Wheat from India.

Let us now turn to the Indian statistics of export, remembering that they are compiled not, like the British statistics, for the calendar year, but for the year ending 31st March. The Indian figures for the present financial year are not yet available, so that I will now deal with the trade for the five years ending 31st March 1909. The first year of the series was the record year for exports, and the last a very poor year. For those five years the total export of wheat from India averaged 19½ million cwt., and of this on the average 15 million cwt., or 77 per cent., were shipped to the United Kingdom. According to the British statistics the quantity of wheat that arrived in the United Kingdom on the average of the corresponding years was 16½ million cwt., the difference between the two sets of statistics being probably due, partly to the fact just explained that the British and the Indian statistical years do not cover exactly the same period, and partly to the diversion of some cargoes *enroute* from foreign countries to the United Kingdom. On the average of the same series of years 78 per cent. of the whole Indian export of wheat was shipped from Karachi, and only 11 per cent. from each of the ports of Bombay and Calcutta. If, however, we take the last three years of the series, we find that

90 per cent. of the total Indian export of those years came to the United Kingdom, and that 96 per cent. of it was shipped at Karachi. To bring the figures up to date, it may be mentioned that during the nine months ending 31st December last the total shipments of wheat from India were 19 million cwt., and that of this 14 million cwt., or 72 per cent., were shipped from Karachi, and $2\frac{2}{3}$ million cwt. from each of the ports Bombay and Calcutta. It may be said then that of the total import of wheat received by the United Kingdom from India at least three-fourths may be expected to come from Karachi; and that as regards the export of wheat the United Kingdom is by far the best customer of India; so that the Indian producer, in growing wheat for export, had best study the requirements of the British market.

Turning from quantities to values, we find that on the average of the last three years the total imports into the United Kingdom of wheat and wheat-flour were valued at 47,000,000*l.*, and of this the import from India was valued at over 5,000,000*l.*, or nearly one-ninth; but the year 1908 was an exceedingly poor one in India, and the value of the imports from India in the other two years of that series averaged 7,000,000*l.*, or one-seventh of the value of all wheat imported; and this figure may be taken as representing the present value of the trade in Indian wheat to the United Kingdom. The average value, according to the Indian returns, of all wheat exported from India by sea during the five years ending March 1909 was 5,800,000*l.*, and of this 4,500,000*l.* was the average value of the wheat exported to the United Kingdom; so this latter figure represents the average annual value to India of the wheat export to England.

If, for purposes of comparison, we take the figures of the year 1907, the last fair year for which complete figures are available, we find that in that year the average retail price of wheat in the Punjab was 23*s.* 2*d.* per quarter, the average declared value of the exported wheat on the sea-board was 27*s.* 6*d.*, and the average declared value of the Indian wheat imported into London was 35*s.* 8*d.* per quarter, the difference representing cost of handling and transport, insurance, profit, etc. Of the 7,000,000*l.* paid in that year by the British buyer for 18 million cwt. of Indian wheat the Indian farmer received nearly 5,000,000*l.* for his wheat, the Indian railways received about 1,000,000*l.* for carrying it to the

sea-board, the ship-owners received 800,000*l.*, as freight from India to this country at 16*s.* for 18 cwt., and the remaining 200,000*l.* or 300,000*l.* went to pay the middlemen and merchants who collected it and brought it from the Indian to the British market.

Wheat Crop of India.

In Table III I have given figures for the area and outturn of wheat in India compiled from the last final general memorandum on the wheat crop for the season 1908-09. The statistics given in crop memoranda for India do not pretend to be absolutely accurate. Even the figures for area sown vary in accuracy for the different provinces. In the Punjab and some other provinces they are based on actual inspection of almost every field by officials, and are, therefore, probably as accurate as in any country in the world; but in Bengal, for instance, they are mostly a compilation of rough estimates made by district officers. The figures for yield must in all countries be merely estimates, and can only be approximate. In India, owing to the ignorance of the mass of the cultivators, and the great differences in the outturn of different fields, it is more difficult than in western countries to make a fair approximation to the truth. In recent years great efforts have been made to improve these memoranda and forecasts of crops, and they are becoming more complete and trustworthy every year; but from the nature of the case, the figures for yield must always remain only rough estimates. My own impression is that they do not fully represent the great differences in outturn of different years, owing to the reluctance of reporting officers in making their estimates to depart far from the average. For instance, they put the gross outturn of wheat in the very dry year 1907-08 at about three-fourths of the average. I should think it was probably really less than two-thirds of the average. However, taking the figures as they stand, they give the following results.

On the average of the last seven years the area sown with wheat in all India was over 26 million acres,* and the produce over 8

* The Agricultural Statistician of the Board of Agriculture estimates that the wheat area of the world cannot now fall far short of 240 million acres, an increase of 45 million acres within the last 15 years. If this is correct, India's wheat area is about one-ninth of the world's wheat area.

million tons, the average outturn per acre being 11 $\frac{1}{2}$ bushels, at 60 lbs. to the bushel. I see from the *Economist* that, according to Dornbusch's List, the world's wheat crop has for the last six years averaged 408 million quarters (87 million tons), India having produced on the average 37 million quarters (nearly 8 million tons), and the United Kingdom 7 million quarters (1 $\frac{1}{2}$ million tons), so that, according to this estimate, India produced one-eleventh of the world's total output of wheat, and five times as much as the United Kingdom. For the five years ending 1908-09 the total exports of wheat from India averaged close on a million tons, so that India exports on the average about one-eighth of its total output of wheat. The average imports of wheat from India into the United Kingdom are 16 million cwt., so that this country receives just one-tenth of the total output of wheat in India.

On the average of the last seven years the Punjab (including its Native States) had 31 per cent. of the total average under wheat in India, and 39 per cent. of the total output; and the United Provinces had 25 per cent. of the average and 29 per cent. of the output. Including the small provinces of the north-west frontier and Sind, these northern provinces of India accounted for 62 per cent. of the total acreage under wheat, and 73 per cent. of the total output: that is, nearly three-fourths of the wheat grown in India are produced in these northern provinces. According to these statistics, the average outturn per acre, which is 11 $\frac{1}{2}$ bushels for the whole of India, is 14 $\frac{1}{2}$ bushels for the Punjab and 13 $\frac{1}{2}$ bushels for the United Provinces, being higher than in the rest of India, partly because the more northern latitude of these two provinces is more favourable to the growth of wheat, and partly because a larger percentage of the wheat grown is irrigated in these provinces than in others. These average outturns may be compared with those for other countries, which I have taken from the *Indian Trade Journal*: Australia 9 bushels per acre, Russia 10, the Argentine 11, Italy, Spain, and the United States 13, Austria 17, Hungary 18, France 19, Manitoba 19, Ontario 20, Germany 28, and the United Kingdom 31.

The acreage under wheat in the Punjab has been expanding in recent years, while in the other important provinces it has fallen off, no doubt mainly owing to the unfavourable seasons of the last two years. The Punjab is likely to grow more and more wheat, as

a larger area comes under irrigation from the new canals now under construction. Already it produces on the average three million tons of wheat, about two-fifths of the total output of India.

I may bring these figures up to date by adding some information about the wheat crop now being harvested. Owing to a favourable monsoon, the seed-time was unusually propitious, and according to the second general memorandum issued in March, the total area sown with wheat this year is 27,700,000 acres, more than a million acres above the average of the previous seven years, and nearly two million acres more than were sown last year. The winter rains have been exceptionally seasonable, and the condition of the crop in northern India is, according to last reports, almost uniformly good. It may have suffered from rust or hot winds, or may be injured by excessive rain at harvest-time, but the probabilities are that, when the final figures are available, the wheat crop of India, which is now being reaped, will be found to be up to the record crop of 1904, with 28 million acres under wheat and a total output of 10 million tons. As in that year, India may again this year supply the United Kingdom with $1\frac{1}{2}$ million tons; and, unless London prices fall rapidly, which they show no signs of doing, it is possible that the imports of Indian wheat into this country this year may reach $1\frac{1}{2}$ million tons. The stocks of other grains in India are at present ample, and their prices low in comparison with that of wheat: so that there will be plenty of wheat available for export. It seems probable that for some years to come India will supply Britain with an average, including bad years, of a million tons per annum, or, say, one-sixth of its total requirements from abroad.

Wheat Crop of the Punjab.

As I have already pointed out, about three-fourths of the Indian wheat imported into this country come from Karachi, which is fed almost entirely by Sind, the Punjab, and the North-West Frontier Province. Sind produces comparatively little wheat, so that almost all the wheat shipped at Karachi comes from the Punjab (with its Native States) and the North-West Frontier Province. I have compiled figures of export from this area from the Internal Trade Report of the Punjab. It must be borne in

mind that the year of this report ends on 31st March, so that the wheat crop which is harvested in April and May, and is dealt with in the season and crop report for the year ending 31st May, figures in the exports for the following year. For instance, the wheat grown in the agricultural year 1907-08 was exported in the trade report year 1908-09, and appears as an import in the British trade statistics for the calendar year 1908. The figures are not yet available for the export of the wheat crop of 1909. On the average of the six years ending 31st March 1909, the total export of wheat from the Punjab area was $17\frac{1}{2}$ million cwt., of which over 14 million cwt. went to Karachi for export by sea. Table II shows that on the average of the last five years the quantity of wheat annually exported from Karachi was just over 15 million cwt., so that practically the whole of the wheat exported from Karachi comes from the Punjab area. Thus it appears that about three-fourths of the total imports of Indian wheat into the United Kingdom come from the Punjab, about half of those total imports, or nearly half a million tons per annum, coming from the tract between the Sutlej and Jhelam rivers, which is watered by three great canals, the Bari Doab, Chenab, and Jhelam canals, and contains the important grain markets of Amritsar, Lahore, Lyallpur, Sargodha, and Multan; so that, with regard to the interests of the wheat import trade into this country, attention may be chiefly directed to this tract, namely the central Punjab, the 14 districts of which last year produced 2,100,000 tons, that is, three-fourths of the whole Punjab output of wheat, and more than one-fourth of the whole Indian output.

Table III gives the average gross outturn of wheat in the Punjab (with its Native States) and North-West Frontier Province, as 3,440,000 tons, or, say, 70 million cwt., so that this area annually exports about one-fourth of its whole wheat output, and about one-fifth of its wheat crop finds its way through Karachi mainly to the United Kingdom. This shows the importance of the British market to the Punjab wheat farmer.

In Table V I have given figures for the 29 districts of the Punjab under direct British rule, taken from the Punjab season and crop report, omitting the Native States and the North-West Frontier Province. They are more accurate than those in the crop memoranda, as they are founded on more careful compilation

and on estimates made after the harvest has been reaped. According to them, on the average of the last seven years, the total area of all crops sown in the Punjab proper was nearly 28 million acres, of which eight million acres were under wheat, and of this a little more than half was irrigated. On the average of the last three years the average outturn per acre was 12 bushels, the average for irrigated wheat being 15 bushels, and for unirrigated wheat 9 bushels per acre sown. But it must be remembered that 1907-08 was an excessively dry year and 1908-09 an excessively wet year, and that, on the whole, the area under cultivation and the irrigated area are steadily increasing, owing mainly to the gradual development of the great canals. This year the area under wheat in these 29 districts is 8,720,000 acres. I would estimate the present normal area of all crops sown in the Punjab proper at 30 million acres, the normal wheat area at nearly nine million acres, and the normal outturn of wheat at nearly three million tons, the average outturn per acre sown being about 13 bushels, that for irrigated wheat being 16, and for unirrigated wheat about nine bushels per acre. As the new canals develop, the cultivated and irrigated area will continue to expand, and the area under wheat, its gross outturn, and the surplus available for export, will increase. These 29 British districts of the Punjab themselves will soon have an average area of 10 million acres under wheat, and be able to spare for export a million tons of wheat per annum, part of which, however, will probably, as hitherto, be consumed in other provinces of India itself.

It is well to remember that in the Punjab there are $1\frac{1}{2}$ million peasant proprietors, each cultivating his own land, and about a million tenants, so that on the average, each farmer cultivating wheat probably has not more than 4 or 5 acres under that crop, many of them much less. A man farming on so small a scale cannot afford to take risks, and will not adopt a wheat different from what he is accustomed to grow, until he is quite certain it is going to pay him better. Nor can the Agricultural Department recommend a new type of wheat to him, until they have made quite sure that it will suit him to grow it. It will, therefore, be some years before a general improvement in the quality of the wheat grown in India can be secured. In the central Punjab, however, from which half the wheat imported from India comes, in the new canal colonies, there is a numerous body of prosperous farmers with

larger holdings of 28 or 56 acres, who grow each from 10 to 20 acres of wheat every year, and who have more capital and enterprise than most of their neighbours; and these men, as well as the large landowners, may be expected to adopt any promising new types of wheat brought to their notice, and should their experience show them that these new types give a good outturn and command a better price in the market, there may be a rapid improvement in the quality of the wheat exported from that area. Much of the wheat grown in India, however, must continue to be grown on comparatively poor, unirrigated, or unmanured land, and we must be content with a very gradual improvement in the average outturn and average quality of Indian wheat as a whole. To indicate what is possible, I may mention that already in the Punjab many fields of irrigated and manured land give an outturn of over 30 bushels of wheat per acre, and that several varieties grown on a small scale on the Government farm at Lyallpur, yielded over 40 bushels per acre.

The wheat harvest in northern India begins in the end of March and goes on through April and May. Little new grain is exported till May, and in an ordinary year the bulk of the wheat exported leaves India in June, July, and August.

Prices of Wheats in London.

In Table VI I have given prices of typical wheats in the London market, when choice white Karachi is selling at 40s. the quarter, which is about its present price (April 1910), but in comparing the prices of wheats from different countries it is necessary to allow for the differences of trade custom, which exist to an extraordinary degree, and I have endeavoured by doing so to calculate what is the actual price paid by the buyer in each case for 480 lbs. weight of pure wheat. As regards all Indian wheat the quarter means a net weight of 492 lbs. So that when the quoted price is 40s. per quarter, this means that the buyer pays only 39s. for 480 lbs. The quotations are c. i. f.; that is, the seller pays the cost of insurance and freight, and the buyer gets the wheat delivered over the ship's side at the price stated. The bags are given free, and as the buyer can get about 8d. a quarter for them, that means that he pays for the wheat itself 8d. less per quarter.

than the price agreed on. The buyer gets off 2 per cent. discount and interest for 60 days at 5 per cent., or in all $2\frac{5}{6}$ per cent., so that if he pays cash, he pays 1s. 1d. per quarter less than the price agreed on (taking that price as 40s.). On the other hand, under the conditions of the Indian wheat contract, the buyer pays at the wheat price for 2 per cent. of barley grain and other feeding grains, and, of course, generally gets at least that proportion. If we assume that those grains are worth to the buyer half the price of wheat, this means that he loses 1 per cent., or, in other words, he would pay 1 per cent. more than the price agreed on, if he were sure of getting nothing but pure wheat. That is, he considers the wheat itself worth 5d. more per quarter than he pays for the mixture. Making all these allowances, it appears that when the price quoted for Indian wheat is 40s. per quarter, the buyer really pays only 37s. 8d. for 480 lbs. of pure wheat.

British wheat is paid for in cash at 504 lbs. to the quarter, free on rail, so that, without making any allowance for the varying railway freight, when it is quoted at 37s. a quarter, the buyer pays only 35s. 3d. for 480 lbs.

In the case of Russian wheat, two per cent. discount is allowed, plus interest at five per cent. for about 75 days, and the buyer gets a mixture containing about four per cent. foreign matter, practically all cockle. The quarter is 492 lbs., so that, after making all allowances, when Russian wheat is quoted at 39s. 6d. per quarter, the buyer really pays 38s. 10d. for every 480 lbs. of pure wheat he gets.

Argentine wheat is paid for by the gross weight of 480 lbs. to the quarter, and is generally imported in bulk. Interest is allowed for 90 days from date of arrival of the bill of lading at a half per cent. over short deposit rate, say, three per cent. The buyer expects to get about six per cent. of oats and other foreign matter, so that he really values the wheat at higher than the quoted price. It thus appears that when the buyer pays a nominal price of 37s. 6d. a quarter for Argentine wheat, he really values the pure wheat at 38s. 2d. for 480 lbs.

The eastern ports of the United States now practically export only flour. White Walla wheat from California is bought at 500 lbs. to the quarter, gross weight. Interest is allowed for 60 days at about three per cent. After making all allowances for

interest, tare, and value of bags, when the quotation is 40s. per quarter, the buyer actually pays about 38s. for 480 lbs. of wheat.

Australian wheat is bought at 480 lbs. to the quarter, and similar allowances have to be made in this case also; so that when it is quoted at 39s., the buyer pays 38s. 7d. for 480 lbs. The wheat is practically pure.

Canadian wheat is imported in bulk, and is practically pure and carefully graded. The quarter is 480 lbs., and the only allowance to be made is that for interest, so that when No. 2 northern Manitoba is quoted at 40s., the buyer actually pays 39s. 10d. for 480 lbs. It appears that Canadian wheat is the most valuable wheat imported in any quantity. This is partly owing to its own quality, but partly also to its being carefully graded and transported in bulk, so that it is pure and uniform in character.

About three-fourths of the wheat imported into the United Kingdom from India, come from Karachi, and all the wheat that comes from Karachi is classed in the London market as soft wheat. Of the imports from Karachi about 55 per cent. consist of what is known as choice white Karachi, a soft white wheat; 10 per cent. of choice white Delhi, a more even-running soft white wheat; and 35 per cent. of red Karachi, a soft red wheat with some rather hard grains. Thus nearly half of all the wheat imported from India is the choice white Karachi, which is very mixed in character, but mainly consists of soft white grain, with some admixture of red or hard grains, the fewer the better. Although wheat in the Punjab is often grown from mixed seed, there are many fields which produce wheat much more uniform in type than the cargoes which reach England, and what probably happens is that when a Punjab or Karachi merchant buys wheat for export to England, if the lot is large enough to make it worth while to handle it separately, and consists of even-running soft white plump grains, with few red or hard grains, he ships it as choice white Delhi (very little wheat grown near Delhi really comes through Karachi) and expects to get 6d. or 9d. per quarter extra for it. If the lot, while still consisting chiefly of soft white grains, is not even, and contains some red or hard grains, he ships it as choice white Karachi, the standard class for export. If it contains too many red or hard grains to be so classed, he mixes it

with red Karachi, the inferior class, which commands a price of 6*d.* or 8*d.* per quarter below that of choice white Karachi. He will not, if he can avoid it, buy for export to England any really hard wheat (that is, flinty, or horny, as distinguished from dry or translucent) whether white or red.

Choice white Bombay, No. 1 club Bombay and No. 2 club Calcutta, which command a price in the London market from 1*s.* 6*d.* to 9*d.* a quarter above choice white Karachi, are all soft white wheats; and hard red Bombay, which is practically the only really hard wheat imported from India, is priced lowest of all, about 1*s.* 3*d.* below choice white Karachi.

Broadly speaking then, the softer and whiter a parcel of wheat is, the better price does it command on the London market; and the more it consists of red and especially of horny and flinty grains, the lower is the price it will fetch. Other qualities which tend to raise the price are the size, boldness, plumpness, uniformity, and healthy appearance of the grains composing the sample.

When one compares the net prices actually paid in the London market for 480 lbs. of wheat received from different countries, it appears that the best Indian wheats fetch a price about a shilling a quarter of 480 lbs. below the prices of good Canadian wheat, and that choice white Karachi, which forms the bulk of the imports from India, is worth about 2*s.* a quarter below Canadian, and about 1*s.* a quarter below Australian wheat. When one sees the beautifully clean uniform wheats received from those countries, as compared with the mixed wheats received from India, the wonder is that the difference in price is not greater. Indian wheat commands in the London market a price about 2*s.* 6*d.* per quarter of 480 lbs. higher than average British wheat, its superiority over the homesgrown grain being chiefly due to its greater dryness. On the whole, Indian wheat is of a quality which meets the requirements of the British miller, and if we could only supply him with uniform cargoes of the best qualities of wheat now grown in India, they would command as good a price as almost any in the market.

Punjab and English Prices of Wheat.

In Table VII I have given the annual average prices for the last nine years of wheat in the Punjab and in England. During

these years the exchange value of the rupee has remained steady at almost exactly 1s. 4d., so that every rupee per maund is equivalent very nearly to 8s. per quarter. But in other respects the figures require some adjustment before a direct comparison can be made. The Punjab prices are retail prices, and are the average prices for the whole year at 23 markets. Wheat bought for export is bought wholesale and mainly at harvest-time, so that the price at which it was bought would generally be below these average retail prices. On the other hand, the English prices are average prices for British wheat in England and Wales, and Punjab wheat generally sells in the London market at 2s. to 3s. a quarter higher than British-grown wheat.* So that to get the true difference between the wholesale price of wheat at harvest-time in the Punjab and the price of Punjab wheat in the London market, we have to add about 2s. a quarter to the difference shown in the table. From these figures, therefore, it would appear that when there is a difference in price of about 11s. a quarter, it will pay to export wheat from the Punjab to London, and that, therefore, the average retail price of wheat in the Punjab cannot long remain more than 8s. a quarter below the average price of British wheat in the English markets. In the record year the difference was 10s. a quarter, and in that year an enormous export of wheat took place. On the other hand, in the very dry year 1908 the price of wheat in the Punjab was actually higher than in London, and naturally export practically ceased. The question can be looked at in another way. The railway freight of wheat from Amritsar, one of the principal Punjab markets, to Karachi, a distance of 816 miles, is 10½ annas per maund, or 5s. 3d. per quarter, and the freight by sea from Karachi to London is now about 16s. per ton of 18 cwt., or 3s. 10d. per quarter, so that the total cost of carriage would be 9s. 1d. per quarter, and, allowing for insurance, profit, etc., it would seem that it should pay to export wheat from the Punjab to London, whenever it can be bought

* In 1909 the average Gazette price of British wheat was 36s. 8d. per quarter. In the same year the average declared value of Indian wheat imported into the United Kingdom was 40s. 8d. per quarter. But much British wheat was poor in quality last year, and when allowance is made for this and for adjustments as regards the weight of the quarter, value of bags, discount, etc., it appears that, for 490 lbs. weight, average quality Indian wheat sells in London at about 2s. 6d. higher than average quality home-grown wheat.

in the Punjab at, say, 11s. per quarter below the London price.* At present (April 1910) Punjab wheat is selling in the London market at 40s. a quarter, so that, according to this calculation, its price in the Punjab cannot long be much below 29s. a quarter. As a matter of fact, on 15th February last, the wholesale price of wheat at Amritsar and Lyallpur was 27s. 6d. per quarter. It does not seem probable that the London price of Punjab wheat will fall much below 35s. a quarter this summer, so that its price in the Punjab cannot fall much below 24s. a quarter (Rs. 3 per maund), however large the crop may be. That is a price 18 per cent. higher than the average Punjab price for the six years ending 1906, an increase large enough to tempt the Punjab farmer to sell in a year of plenty such as the present. There is a large supply of inferior food-grains sold now at much lower prices than wheat, so that this price will probably secure a very large quantity of Punjab wheat for export to this country. Except in years of local scarcity, the price of Indian wheat in India is largely determined by its price in the London market, which depends on the demand and supply of wheat in the world as a whole.†

The Future of Wheat.

The future of wheat in India, as in other countries, depends largely on the future course of wheat prices in the world's market, and that depends on wide movements, the effect of which no man can foretell or even estimate with any feeling of certainty. I may be pardoned if I make bold to offer some suggestions on the subject, for what they are worth. There are at present strong tendencies towards an increase in the world's supply of wheat. Owing to a rapid improvement in the means of transport and a cheapening of its cost, as well as to the spread of good government and the accumulation of capital, there are large areas, hitherto undeveloped,

* I have already shown that in 1907 the difference between the average retail price of wheat in the Punjab and the average declared value of Indian wheat imported into the United Kingdom was 10s. 6d. a quarter.

† I understand that Indian gram, a pea-like pulse of excellent feeding properties, much consumed by people as well as by cattle in India, is now finding its way to this country. There is likely to be an abundant crop of gram this year in northern India, and its price will probably be low. So that, if the prices of feeding-stuffs remain high in this country, we may see a considerable import of gram from India this year.

which are likely to be brought within the range of profitable cultivation within the next few years, and we may expect a large increase in the production of wheat in Canada, the Argentine Republic, Australia, Russia, Siberia, India, and elsewhere, merely in consequence of the spread of cultivation. In many countries irrigation greatly increases the outturn of wheat, and irrigation is extending rapidly, as, for instance, in India, the United States, and Canada. Science and education promise, within the next few years, to add considerably to the average outturn per acre. I may also mention another important factor, the effect of which can only be guessed at. Although in this country wheat is more apt to suffer from wet seasons than from dry, in the wheat-growing countries of the world, taken as a whole, there is no more potent cause of the reduction of wheat outturn than drought, and I understand the general opinion among meteorologists is that wet and dry years come in cycles, and that the next few years are more likely to be wet than dry, in which case the tendency would be towards an increase in the world's production of wheat. All these tendencies point to a large increase in the world's supply of wheat in the immediate future, even after allowance is made for the competition of other products which may attract the farmer's attention. But what of the world's demand for wheat? To a large proportion of mankind wheat is the favourite food, and the more they can afford to buy it the more will they buy. During the last half-century at least the amount of capital accumulated in the world has been increasing by leaps and bounds, and the process shows no signs of abating. This means for the population of the world as a whole, a rapid increase in its general prosperity and in its purchasing-power, whether measured in money or in general commodities, and a proportion of that increase will be devoted to the purchase of more wheat, the favourite food. The present population of the world is estimated at 1,800 millions, and every pound's weight per annum by which the average consumption of wheat per head increases, requires nearly another million tons' weight of wheat to meet the growing demand.

According to a correspondent of the *Economist*, the world's output of wheat averaged for the last five years 392 million quarters (Dornbusch's List makes the average 413 millions), while for the previous five years the average was only 356 millions, an average

increase of over seven million quarters (1 $\frac{1}{2}$ million tons), or 1 $\frac{2}{3}$ per cent. per annum. The world's consumption has increased at a faster rate, for prices have risen,* and is likely to go on increasing at at least that rate. Putting all these considerations together, I am myself inclined to the view that for some time to come the world's demand for wheat will increase at least as fast as the world's supply, and that, therefore, the present level of wheat prices is not likely to fall off rapidly. The best measure of the world's price for wheat is its price in the London market, which may be taken as at present 38s. per 480 lbs. for average quality imported wheat, and about 35s. 6d. for 480 lbs. of average quality British wheat. I see that a year ago, in his paper read to the Royal Society of Arts, Mr. Humphries said that he did not anticipate for many years to come an average value of wheat, under normal circumstances, in excess, or substantially in excess, of 30s. With all the deference due to such an authority, and all the diffidence demanded by the complexity of the question, I venture to think that this is an unduly sanguine estimate from the point of view of the consumer, and to put forward the opinion that, for some years to come, the average price of average quality imported wheat in the London market will not fall materially below 35s. per 480 lbs., the corresponding figure for average home grown wheat being about 34s. per quarter of 504 lbs.

It is, perhaps, safer to anticipate that the fluctuations in the world's price of wheat will tend to become less violent as the years go on. The world's demand, though it will probably increase, is not likely to increase otherwise than gradually. The world's supply, though it will still fluctuate greatly with the varying seasons, is likely to fluctuate less and less, as more land comes under wheat in widely separate countries not likely all to have similar seasons at the same time, and as the practice of irrigation extends. We are not likely to see the price of average quality wheat in the London market for any length of time much below 30s., or much above 40s., per quarter of 480 lbs., even if a 2s. per quarter customs duty is imposed on foreign-grown wheat.

* The English price for British wheat has for the last five years averaged 31s. 6d. per quarter of 504 lbs., while for the previous five years it averaged 27s. 6d.

Summary of Statistics.

I will now sum up the conclusions arrived at after an examination of the statistics of recent years bearing on the wheat trade between India and the United Kingdom. The world's output of wheat is now on the average about 90 million tons, and of this India produces about eight million tons, or about one-eleventh of the whole; but both the world's output and that of India are, on the whole, steadily increasing. The requirements of the United Kingdom for foreign wheat have averaged nearly six million tons, and about one-seventh of this has been supplied by India, but the import from India is likely now to average a million tons, or one-sixth of Britain's total requirements from abroad. The area sown with wheat in all India has averaged 26 million acres, and the outturn about $11\frac{1}{2}$ bushels per acre, but the area and average outturn are likely to increase steadily. India has exported on the average about a million tons annually, about one-eighth of its total output, but is likely to increase its export of wheat. Of the total exported about four-fifths found their way to the United Kingdom, which absorbed one-tenth of India's total output. Nearly three-fourths of the wheat grown in India are produced in the northern Provinces, and about three-fourths of its total exports of wheat are shipped from Karachi. Two-fifths of the whole output of India are produced in the Punjab, and about half of the wheat imported from India into the United Kingdom comes, through Karachi, from the central Punjab. More than a fourth of the area annually sown in the Punjab proper is put under wheat, the area averaging eight million acres, half of which is irrigated, and the produce nearly three million tons. That province will soon have 10 million acres under wheat, and be able to export a million tons per annum. The English price of home-grown wheat has averaged 31s. 6d. per quarter of 504 lbs., but is now about 37s. per quarter, or 35s. 6d. for 480 lbs. Indian wheat of average quality sells on the London market at 2s. or 3s. higher than average quality home-grown wheat, and is now worth about 37s. 8d. for 480 lbs. It is not likely to go much below 35s. for some time to come, and as 11s. a quarter is enough to bring wheat from the Punjab, its price in the Punjab is not likely to fall much below 2s., a quarter or three rupees per maund. This year India is likely to export to the United Kingdom $1\frac{1}{2}$ or $1\frac{1}{2}$ million tons of wheat.

Qualities of Indian Wheat.

I propose now to examine the qualities of Indian wheat which make it suitable to the British markets, and in doing so I desire to acknowledge the great services rendered to the Indian farmer by Mr. and Mrs. Howard of the Agricultural Research Institute at Pusa in Bengal, who have identified in the Punjab 25 different types of wheat, have written an admirable memoir on "The Varietal Characters of Indian Wheat," and have started a series of useful experiments with the view of evolving improved types of wheat suited to Indian conditions; by Mr. A. E. Humphries, who has, with much care, labour, and public spirit, subjected Indian wheats to milling and baking tests, and supplied us with the results; and by the Karachi shippers, who have done so much to improve the trade in Indian wheat, and to free it from the reproach of containing, as shipped, a scandalous proportion of dirt. I have also to acknowledge, for myself, the courteous manner in which the various corn trade associations, Mr. Humphries, Dr. Dyer, shippers, millers and others have answered my requests for information.

The tastes of the British consumer in the matter of wheat vary greatly, and a use can be found in the United Kingdom for almost all kinds of wheat. Those tastes are studied by the British miller, whose interest lies in, as far as possible, suiting the supply to the demand. It is chiefly he who purchases the Indian wheat, and his requirements have, therefore, to be studied by all interested in the export of wheat from India, whether producers or merchants. The British miller wants his wheat—

1. *Clean*,—that is, as free as possible from dirt and other useless impurities.
2. *Pure*,—that is, as free from other grains as possible.
3. *Of good quality*, that is, well harvested, and as free as possible from immature, damaged, and weevilled grains.
4. *Uniform*,—that is, as nearly as possible of one character throughout.
5. *Dry*,—that is, capable of absorbing a considerable proportion of water in the process of conditioning.
6. *Free-milling*,—that is, neither liable to be come woolly in texture in the process of being converted into flour, nor flinty nor horny in character.

7. *Stable*,—that is, such that the dough is easily handled in large masses by the baker.

8. *Strong*,—that is, with a flour capacity for making big shapely loaves.

9. *Of a good colour of flour*,—that is, the flour should be of a bright or creamy whiteness, neither too dull nor too yellow.

Cleanness.

As regards cleanness, there has been an extraordinary improvement within the last three years, due to an alteration in the terms of the form of wheat contract adopted in the United Kingdom. Most of the wheat in India is grown on small peasants' holdings, and is threshed by being trodden out by bullocks on an earthen threshing-floor, and winnowed by hand in the wind, so that naturally a certain amount of dust gets mixed with it, and this has always to be reckoned on in buying Indian wheat. Prior to 1907 the custom in England was for the buyer to bargain that he should receive wheat of fair average quality of the season's shipments at time and place of shipment. Nothing was said as to the amount of dirt a cargo might contain, so that it became the interest of every shipper to ship as much dirt with his wheat as he dared, so long as he could hope that the cargo would pass as of fair average quality of the season's shipments. The great bulk of good wheat does not contain more than 1 per cent. of dirt when the farmer delivers it to the first purchaser, but, as it was to each dealer's interest to pass as much dirt with the wheat as possible, the consequence naturally was that, on the way from the first market to the ship, large quantities of dirt and sand were deliberately added to it, and when it arrived in London, Liverpool, or Hull, Indian wheat was, for some years prior to 1907, generally found to contain from 4 to 8 per cent. of dirt, and the British miller, in offering a price for a cargo of wheat, calculated that he would receive only about 94 per cent. of grain and 6 per cent. of dirt, and naturally offered a lower price than he would have done if he could have been sure of getting clean wheat. The fault for this state of things did not rest with the Indian farmer, who delivered his wheat to the first purchaser with something like 1 per cent. of dirt, nor with the Indian middleman, who could not be expected to

deliver clean wheat if he was to be paid for it only the price of dirty wheat, but with the British buyer, who acquiesced in buying on a form of contract which, as worked, absolutely compelled the Indian trader, in his own interest, to mix dirt with the wheat before shipment. The Indian Government had long urged the necessity of a revision of the terms of the contract, and in 1906, after enquiries made throughout India, assured the trade that supplies of Indian wheat could regularly be made containing not more than 2 per cent. of impurities (that term covering all foreign matter other than food grains). At last in 1907 the form of contract between buyers and shippers of Indian wheat was revised, and it now provides that any percentage of dirt, non-farinaceous seeds, or other extraneous matter up to $2\frac{1}{4}$ per cent. is to be allowed for by the seller at the market value of the quality guaranteed on the day on which the steamer reports at the Custom-house, and that any percentage in excess of $2\frac{1}{4}$ per cent. is to be allowed for at the penal rate of double that market value. The effect of this stipulation is that the seller receives payment only for the grain contained in the cargo, and gets nothing for the dirt he delivers, and has to be careful that the cargo does not contain more than $2\frac{1}{4}$ per cent. of dirt and oilseeds, otherwise he will not get full payment even for the grain he delivers, in consequence of the penal rate. Thus it is now everybody's interest to keep the wheat as clean as possible, and it is no longer anybody's interest to intentionally mix dirt with the wheat.

This condition is now enforced by the London, Liverpool, and Hull corn trade associations, and governs the whole trade in wheat between India and northern Europe. It is worked in the following manner. The buyer selects one bag for each 100 tons of the cargo, subject to a minimum of five, and a maximum of 60 bags. These sample bags are sent in sealed dust-proof covers to the corn trade association, which has accepted the responsibility for the analysis. The whole of the contents are passed through an ingenious sample-reducing machine, the object of which is to obtain a small sample of manageable size (usually one per cent. of the whole contents of the sample bags) which shall fairly represent the whole sample, including the dirt and other foreign matter it contains. The machine mixes up the whole contents of the sample bags and separates off one per cent. of these contents, especial care

being taken that it shall give in the small sample the same proportion of dirt as is contained in the whole sample. The small sample is then sent to the analyst of the corn trade association who, in a similar machine, again reduces it to a still smaller sample, and very carefully weighs the percentage of dirt it contains. The percentage thus ascertained is accepted by both buyer and seller, as determining the percentage of dirt in the whole cargo, and a series of experiments has shown that this process gives very accurately the true percentage.

The effect of this alteration in the form of contract has been most satisfactory. The result of the analyses of the samples representing 30 consecutive parcels of Karachi wheat imported into London by various shippers sampled during the three months, November to February last, representing in all 316,530 bags, has been that they were found to contain on the average only 1·11 per cent. of earth, oilseeds, and other extraneous matter, the minimum being 0·68 and the maximum 1·44, except in the case of one sample, which contained 2·02 per cent. In 20 out of the 30 cases the proportion was just round about one per cent. In Liverpool a similar improvement has been experienced. During last season (June to November 1909) samples of 111,000 tons of Karachi wheat were analysed by the Liverpool Corn Trade Association, and on the average they were found to contain only 1·16 per cent. of dirt and other extraneous matter. In Hull also, in 215 parcels of Karachi wheat representing in all 2,217,556 bags, imported during the 11 months ending with March last, the average proportion of dirt was found to be 1·23 per cent.; and in 71 of the 215 cases the proportion was about one per cent. And I understand that millers throughout the country have had a similar experience, and that Indian wheats have been steadily advancing in favour amongst them accordingly, so that they command relatively a much better price than they did some years ago.

Before the change made in the form of contract, the percentage of dirt and useless matter seems to have averaged about 6 per cent.; now it averages about 1·2 per cent. This means that the Indian wheat trade is now relieved from the burden of bearing the cost of carrying about 5 per cent. of Indian earth from India to England; the British miller is saved the cost of cleaning that amount of earth out of the wheat, and the Indian middleman is saved the

necessity under which he formerly laboured, of putting that amount of dirt into the wheat. The saving of cost of freight alone is considerable. The average quantity of Indian wheat annually imported into the United Kingdom in the last seven years was 16,000,000 cwt. Five per cent. of this is 800,000 cwt. The freight from India to England was nearly 1s. a cwt., so that the saving in freight of dirt, due to the change in the form of contract, is about 40,000*l.* per annum. The British consumer and miller must have secured a portion of this saving, and a large portion of it must eventually reach the Indian farmer, owing to the better reputation his wheat now has in the British market, and the better price it, therefore, commands. The middleman and merchant may be trusted to look after their own interests. The only people who may have suffered by the change are the shipowners, who no longer receive 40,000*l.* a year for bringing Indian dirt to England, and the Indian coolies, who have lost the easy employment of mixing dirt with wheat. The soil of England has also been deprived of the advantage it used to enjoy of having added to it 40,000 tons of Indian dust every year!

If I may presume to offer an opinion, it is that the British buyer of Indian wheat should secure the advantage he has gained by insisting on penalising any percentage of dirt over 1½ per cent., instead of the present rate of 2½ per cent. Recent experience has shown that he can easily get Indian wheat with little more than 1 per cent. of dirt, and a 1½ per cent. allowance would, in London, only have penalised one cargo in the last three months. It must be to the advantage of the British buyer to get his wheat as clean as possible, and the cleaner he can get it the better price will he be prepared to pay for it; and the better the reputation of Indian wheat in the British market, the better will be the price ultimately secured by the Indian producer. In any case, it is worth the while of the Indian farmer to send his wheat to market as free from dirt as possible; for now the loss of freight on dirt falls on the middleman and merchant, and it is to the interest of the first purchaser to buy clean wheat.

Purity.

The ordinary Indian farmer is very careless in selecting his seed, and often sows wheat containing an admixture of barley,

gram and other grains. The consequence is that an ordinary cargo of wheat from India contains a considerable quantity of such grain other than wheat. The separation of these grains does not cost the miller much trouble, and they have a value in the British market; they are, therefore, treated in the contract between buyer and seller on a different basis from that applied to dirt and oilseeds. The present form of contract provides that any percentage of barley, pulse or other feeding-stuffs up to two per cent. shall be taken and paid for as wheat, and that any quantity in excess of two per cent. shall be allowed for by the seller at one-half the price of wheat. The analysis of samples for this purpose is done at the same time as the analysis for determining the percentage of dirt, and the process is the same, except that the different grains have to be separated out from the sample by careful hand-picking. The result of the analysis in London of the same 317,000 bags already mentioned was that the cargoes were found to contain on the average 5·66 per cent. of barley, pulse and other feeding grains, the lowest percentage in any individual sample being 3·00, and the highest 8·47. In Liverpool the samples of 111,000 tons last season were found to contain on the average 5·16 per cent. of barley, pulse and other feeding-stuffs; and in Hull 2,217,556 bags contained on the average 4·99 per cent. of these grains. The working of the contract may be gathered from the following example of a fairly average cargo, found on analysis to contain 1 per cent. of dirt, 6 per cent. of barley and pulse, and only 93 per cent. of wheat; sold at 40s. per quarter. For 1,000 quarters of this cargo of fair average quality the nominal price would be 2,000/-, but as the result of the analysis one per cent. of this would have to be deducted for dirt, and 2 per cent. for other grains (this being half the excess of the actual content of 6 per cent. of barley and pulse over the free allowance of 2 per cent.). So that instead of being paid 2,000/- for every 1,000 quarters, the seller would get only 1,940/-, that is, he would lose 3 per cent. of the contract price because of the admixtures his wheat contained. Seeing that the price of barley and gram in India is usually more than half that of wheat, it does not pay anybody to deliberately mix barley and gram with wheat; but it is still to the interest of the shipper not to deliver pure wheat, because he would be paid for it only the same price as he would be paid for a cargo containing

2 per cent. of barley. Suppose the shipper has two lots of wheat each consisting of 100 quarters, both of fair average quality, free from dirt and sold at 40s. a quarter, but that one lot is pure wheat and the other contains 10 per cent. of barley. If he delivered them separately, he would get 200*l.* for the first lot without deduction, and only 192*l.* for the second lot, as he would only get an allowance of 2 per cent. for the barley and would be paid only half price for the remaining 8 per cent.; that is, he would receive 392*l.* in all for his 200 quarters. But if he mixed the two lots together, so that the mixture contained 95 per cent. of wheat and 5 per cent. of barley, he would get the allowance of 2 per cent. for barley, and be charged half price for the remaining 3 per cent.; that is, the deduction on the 200 quarters would be 6*l.*, and he would receive in all 394*l.* for his 200 quarters, instead of the 392*l.* he would receive if he delivered the lots separately. Thus it pays him to mix pure with impure wheat. And this is, no doubt, what he does; for there is a good deal of wheat delivered practically free from barley and grain by the Indian farmer to the first purchaser, and practically none of it reaches the British market in a pure state. So long as the present form of contract stands, the shipper will, in his own interest, take care never to deliver a cargo of wheat in England with a less admixture of barley and grain than 2 per cent., and the British miller will seldom receive pure wheat from India. On the other hand, the miller will only offer the price he is prepared to pay for 98 per cent. of wheat and 2 per cent. of barley, and the reputation of Indian wheat will continue to suffer, not from any fault of the grower, but owing to the form of contract.

Here again, if I may presume to advise, I think it would be to the interest of the British miller, and ultimately of the Indian grower, to insist on the abolition of the 2 per cent. allowance for barley and grain, and to pay only half the price of wheat for any admixture of other grains, however small. It would then be to everybody's interest to grow wheat free from any admixture, and to deliver it in the British market in as pure a condition as possible. The miller would get purer grain and would pay a better price for it, and ultimately the Indian grower of pure wheat would get a better price for his carefully grown grain. In any case, however, it will pay the Indian farmer to take pains to grow pure wheat and to send it to market as free from admixture

of other grains as possible, for the first purchaser will pay him a better price for pure than for impure wheat, as it is to his interest, even now, to do so.

Quality.

Apart from the question of the percentage of dirt and of foreign grains in a cargo of wheat, its value depends on its quality. It may consist of well-formed, well-ripened grains, or it may contain a large proportion of imperfectly ripened grains or of grains damaged by drought, rain, frost, rust, or weevil. Where a dispute arises between seller and buyer as to quality, it is determined by arbitration. When samples are sent to the analyst for the purpose of analysis, other samples are drawn from the mixed-up contents of the sample bags and sent, one to the Corn Trade Association for standard purposes, and one each to the seller and buyer for arbitration purposes. From the samples received of the cargoes shipped from a particular port in each month, the Association makes up for reference a standard sample to represent the "fair average quality" of the month's shipments from that port, and if a buyer thinks his purchase is below that fair average quality of the month's shipments he can apply for arbitration, and if the arbitrators find that the wheat shipped is of a distinctly different quality or description to that guaranteed in the contract, the seller may either be required to take the wheat back or the arbitrators may require him to pay an allowance for inferiority of quality or difference in description, and in either case may also award damages not exceeding 2s. per quarter against the seller. This provision leads the shipper to try to keep up the quality of each cargo to the fair average quality of the month's shipments, and, if he thinks any particular cargo is in quality superior to that fair average quality, it is open to him to sell it, not as of fair average quality, but on a special sealed sample. It is thus everyone's interest to keep up the quality of shipments and to the advantage of the Indian farmer to market his wheat in as good condition, as to quality, as he can.

Uniformity.

The miller would prefer to get his wheat uniform in character, so that it may give uniform results in the processes of conditioning

and milling, and would rather do any necessary mixing of wheats himself than have wheats of different characters mixed before they reach him; and, therefore, other things being equal, he will pay more for wheat of uniform character than for a mixture. The wheats that reach him from the United States, Canada, and Australia are wonderfully uniform, because they are grown in large quantities from carefully selected pure seed of uniform character; but the wheats that reach him from India usually consist of a mixture of different kinds of wheat, often differing from each other in conditioning and milling qualities. And it is a matter for surprise how little difference there is in the British market between the prices of these mixed Indian wheats and those of the more uniform wheats from other countries, and goes to prove how suitable Indian wheats as a whole are to British requirements. The reasons for the mixed character of Indian wheats are that many growers take little care to see that their seed is of one type, and that the ordinary Indian holding is so small that its produce cannot be kept separate in the market, and the middleman is forced to mix it with other similar parcels before it is shipped to England. There can be no doubt that uniform parcels would command a better price in the British market than mixed parcels do, and, other things being equal, it would be to the advantage of the Indian growers of any particular locality if they could be induced to grow over a large area the same type of wheat, so that it would be easy for the middleman to make up a large parcel of that type and keep it separate till it reached the British market. This object would be facilitated by the erection of elevators where the wheat could be graded as received; and partly for this reason, and partly because it would relieve the congestion on the railways during the busy season. I should be glad to see an elevator tried experimentally, say, at Lyallpur, at the expense of the Government. If elevators proved successful, they would be of great advantage to the railway administration, and it seems to me that the cost of the experiment might well be borne by the North-Western Railway, which is owned and managed by Government, so that any loss on the experiment would fall on the general taxpayer, who, on the other hand, would benefit, both directly and indirectly, if the experiment turned out successful. It might also pay the Railway to charge lower freights in the slack than in the busy season, so as to

induce merchants to spread the demand for waggons more evenly over the year.

It is also important to the miller that the individual grains should be consistent in texture, so that they may yield uniformly to the adjustment of moisture prior to grinding. It seems that over-irrigation, such as wheats grown by the aid of canal irrigation frequently receive, tends to the production of mottled grains, that is, individual grains, some parts of which are drier and capable of absorbing more moisture than others. Apparently the only cure for this is more careful irrigation, and more judicious selection of seed.

Dryness.

Other things being equal, the drier a wheat is the more valuable is it to the miller, because it will absorb more moisture in the process of conditioning and give a greater yield of flour. Most Indian wheats are comparatively dry, and this is one reason why they fetch a better price than ordinary British-grown wheats, which are naturally moist. Dryness must not be confounded with hardness, as it is apt to be, because a grain of wheat is harder, in the ordinary sense, the less moisture it contains. Red Karachi is drier and, therefore, in the ordinary sense, harder than choice white Karachi, but it also is classed as soft on the London market, because it is not flinty, tough, or horny, and becomes soft when moisture is added to it, while the true hard wheats do not mill freely, even when damped.

Free-milling.

The best kinds of wheat for the miller are those which are mellow and mill freely, that is, can be ground easily and can be divided out into their ultimate commercial constituents of flour and husk with the greatest ease. This is a most valuable characteristic, and here again it is important to distinguish it from hardness and softness. Millers do not want flinty wheats like durums (macaroni) wheats, which remain hard when moisture is added to them, and especially they do not want tough or horny wheats; nor, on the other hand, do they want such soft wheats as become woolly

when their moisture is adjusted, as it is more difficult in the case of woolly wheats to effect a proper separation of husk from kernel. Practically all the wheat imported from Karachi is free-milling, and it is important to preserve this quality, and neither to encourage the growth of really hard flinty or horny wheats, nor of very soft woolly wheats, such as Muzaffarnagar wheat apparently is apt to become when grown in the north Punjab under excessive irrigation.

Stability.

Stability means the facility with which large masses of dough can be handled by the baker. Apparently the stability of a wheat can be judged only by a baking test.

Strength.

One of the most important characteristics of wheat used for baking purposes is its strength, that is, the capacity of the flour for making big shapely loaves. There is reason to believe that the strength of a wheat has some connection with its nitrogen content, but it is a question to be determined more by experiment than by analysis. Mr. Humphries found that some of the red wheats grown in the Punjab, which are dry, but not really "hard" wheats, are very good as regards strength, and considered them, for this and other reasons, more valuable to the miller than the soft white wheats known in India as Muzaffarnagars, which, I believe, would be classed as choice white Delhi, or placed in the mixture of soft white wheats known as choice white Karachi. From the experiments made in India, and the baking tests carried out by Mr. Humphries, there is some reason to think that irrigation tends to make wheat softer and moister, with less nitrogen content, and less strength. If so, it may be found that the wheats most valuable to the miller are those grown with little or no irrigation, which, though still soft free-milling wheats, may be harder (in the ordinary sense), drier, more uniform in texture, contain more nitrogen, and give stronger flour than the irrigated wheats. If this were found to be the case, it would make it all the more important that the farmer should be urged not to over-irrigate his wheat, as he is too apt to do on lands irrigated from the canals.

Colour.

Colour of husk is now of comparatively little importance, as the miller can get rid of the husk easily, except in the case of soft woolly wheats, but, on the whole, other things being equal, he prefers white wheats to red, and a much larger proportion of the white wheats grown in northern India is actually exported than of the red wheats. That this preference is not a strong one will be seen from the fact that soft red Karachi sells in the London market at only 4*d.* to 8*d.* per quarter of 480 lbs. below choice white Karachi. Still the fact remains that white wheat is preferred to red, and while it is safe enough to tell the Indian farmer that he need not despair of selling red wheat at a good price for export, it would be going too far to dissuade him from growing soft white wheat, if it suits him to do so, as, other things being equal, he will, at present, get a better price for it from the British miller; though possibly the miller may in time find that the best red wheats are as good, or better, than ordinary white wheats.

Colour of flour does not greatly affect the value of wheat to the miller, at least among ordinary wheats other than durums, but, other things being equal, he prefers wheats which give a flour of a bright and creamy whiteness to those whose flour is dull or yellow.

Types of Indian Wheats.

Of the wheats generally grown in northern India, apparently, on the whole, those known as Muzaffarnagars are at present most valued by the British buyer. They are soft white wheats classed, I believe, as choice white Delhi, and forming part of the mixture known as choice white Karachi, though probably that is composed more of the white wheats known in the Punjab as *chitti*, *qoni*, *safed*, and *dandi*. Mr. Humphries says of Muzaffarnagar wheat: "This type of wheat would commend itself to those millers who want to produce soft white flour. It would find a ready sale, say, in Ireland, or some parts of the north-east of England, or in other parts, in the absence of English or Australian wheats, and it may be good for biscuit and pudding making; but to me as a miller, making bread-flour for the London district, it is not a desirable type of Indian wheat. It behaves poorly in milling after conditioning." The fact remains, however fit I am right as to its

commercial classification), that these Muzaffarnagar wheats command in the London market a price of from 6d. to 9d. higher even than choice white Karachi, and 1s. or more higher than ordinary red wheat, and so long as this is the case we cannot advise growers to give them up. They seem to deteriorate in quality when grown under irrigation in the Punjab, and are apparently at their best when grown in their natural habitat, the United Provinces, or farther east in the neighbourhood of Pusa.

The Howards have succeeded in growing at Pusa a group of very strong white wheats: Mr. Humphries speaks very highly, especially of one of them, known as Pusa 8 (No. 26 of 1909) of which he says: "It does yield in a substantial degree that toughness of dough characteristic of American spring wheat, in other words, it is quite unlike and much superior to the Indian wheats we ordinarily get in common. . . . It represents a combination of good milling points, first-rate behaviour as dough, and first-class colour in bread."

I understand that the soft white wheats exported from Bombay mainly come from the Central Provinces, where they are known as *pissi*. Mr. Humphries was not much impressed by the *pissi* samples sent him. They behaved in milling as soft woolly wheats, and yielded flour of a chalky white hue, and would not make good bread if used by themselves, though they would be useful for blending if a miller wished to counteract the extreme yellowness of some varieties, and for making pudding or biscuit flour. It is probably owing to these latter qualities, and to their relative scarcity, that the white wheats imported from Bombay command a high price in the London market.

By far the commonest wheats grown in the Punjab are red wheats of various kinds, only the best of which find their way to the British market. They are grown all over the province, and also in the United Provinces, and are known by vernacular names meaning "red" (*lal, surkh, ratti*), and are sometimes called by names meaning "indigenous" (*desi, matni*). The Howards have grown in the Punjab two red wheats, which are commended by Mr. Humphries. They are named *hara* (No. 21 of 1909), and *jana khan* selected red (No. 23 of 1909), and are dealt with by Mr. Humphries along with another Punjab wheat, a white wheat known as *jana khan* selected white (No. 22 of 1909), as follows:

"These wheats . . . are, in my opinion, very attractive. The *hara* is a small, round-berried red wheat of a particularly deep red hue, very even in texture, and contains no soft or pale grains. The hue is peculiar, and that point is not a good one. The red *jana khan* may be called a sister wheat to the *hara*. This also has a peculiar hue, almost that of dark mahogany. It is larger in berry than the *lara*, and like it contains no pale or soft corns whatever. The white *jana khan* is of particularly nice appearance, mostly round-berried, of Pife shape, distinctly hard* as received, very translucent, without any pale or soft corns in the sample. These three wheats behaved particularly well in conditioning and milling, and that weighs greatly in my opinion. Of the three the white *jana khan* is the best on that point. Although they are hard, the flours they yield are not yellow, and the bread has the hue which one associates with Manitoba wheat, a greyish but bright white. In these three cases the toughness of dough characteristic of American spring wheat again occurs, and is, in my view, most noteworthy. The bread is very attractive in appearance, with first-rate pink and beautiful crusts. The loaves are not so big as those which British bakers obtain from Manitoba or American spring wheat flours, but they yield that type of bread, and if some malt extract were added in milling or baking to break down still more the effects of great hardness, I believe that truly superb bread would be obtained from them. . . . Millers or merchants buying wheats on appearance would prefer the white *jana khan*. It also mills better than the other two, but the red *jana khan* behaves best in the bakehouse. On balance, however, and having regard to the results which would probably ensue from further adjustments of milling and bakehouse treatment, I should say that the white *jana khan* is the best of the three." He adds: "It will be gathered that several of the wheats sent me are very good. The most significant is No. 26 (Pusa 8). In No. 22 (white *jana khan*), regarded as typical of its group, we have a wheat which looks really good and is so. It yields a granular lively flour, and in the estimation of most bakers a really stable and strong flour is granular. But in the case of No. 26 (Pusa 8) we have a flour which seems to be a compromise between the lively granular

* That is, hard in the sense in which Manitoba wheats are hard, but not like durum wheats.

flour just mentioned and the soft white flour such as that from the *pissis*, yet it is really strong. If as a miller I could not have both, I would choose the white *jana khan*. But many millers would not, and it seems to me that No. 26 (Pusa 8) should be tested exhaustively in several districts. It is, in my opinion, a most promising wheat."

It appears from these valuable milling and baking tests that the Howards are working on the right lines, and that they have evolved in Pusa 8 a very superior wheat, which can be grown in Behar and probably in the east of the United Provinces; and in white *jana khan*, red *jana khan*, and *bara*, excellent types of wheat suited to Punjab conditions. There is some danger, however, lest a misunderstanding of the word "hard" as applied to wheat may mislead the agricultural departments in India. As I understand the question, while millers prefer wheats from India which are dry and capable of absorbing a considerable quantity of moisture, and are, from their dryness, in a sense "hard," they do not want really "hard" wheats, which are flinty, or horny in nature, and remain hard after conditioning, such as the durum (macaroni) wheats. Very little wheat of this character is exported from the Punjab, though some is grown and is known as *rajhānak* or *dāgar*. It is considered to give a larger outturn than ordinary red wheat, and its flour is whiter, but not so nourishing, while its straw is very inferior. There seems to be no ground for encouraging the growth of wheats of this really hard character, so far as the requirements of the British miller are concerned.

Advice to Indian Growers.

So far as I can judge from this examination of the present conditions and prospects of Indian wheat, we can safely give the following advice to the Indian farmer:—

1. Whatever wheat he grows, he will find it to his advantage to sow pure seed, uniform in character, both as regards the resemblance of the different grains to one another and as regards the uniformity of texture throughout each individual grain, and to market it in as clean, pure, and uniform a condition as possible. He should avoid over-irrigating his wheat, as this tends not only to reduce the outturn, but to make the grain non-uniform, that

is, in part soft and in part hard, in the ordinary sense of those words.

2. He must think of his own tastes and of those of the local market, and it may pay him best to grow some wheat which commands a high price locally, or a durum wheat for export to southern Europe to be used in making macaroni, but, generally speaking, the British miller is his best and steadiest customer, who will on an average of years pay him the best price for his best wheat; so that, as far as price is concerned, he had better grow the wheat that is most valued by the British miller.

3. Outturn is the first consideration. All wheat has its value, and the difference in selling price between different types of good wheat is not great. Ordinary red Karachi wheat sells in the London market at less than a shilling a quarter below choice white Karachi, that is, the difference in price is less than two annas per maund, and if the Punjab farmer can grow 18 bushels per acre of red wheat and sell it at Rs. 2-11 per maund, for the same cost as it requires to grow 16 bushels per acre of white wheat, worth Rs. 3 per maund, it will obviously be to his interest to grow red wheat, and not white.

4. Other things being equal, he should grow soft, dry, free-milling wheat, and not really hard, flinty, or horny wheat, or soft woolly wheat.

5. Other things being equal, he should, so far as price is concerned, grow white wheat rather than red, as white wheat at present fetches one or two annas a maund more than red wheat of similar quality; though, possibly, in time British millers will find that good red wheat is as valuable for their purposes as good white wheat.

Duty of Indian Experts.

The experts should proceed on similar lines in developing wheats which will command the best price in the market, but they must remember that average outturn is much more important than price, and that they have to think not only of the selling-price of the wheat, but of its hardiness, suitability to the soil and climate, period of growth, date of ripening, drought-resistance, rust-resistance, resistance against damage by birds, insects, weevils, etc. In short, the main object to be kept in view is to give the farmer the

wheat which, on an average of seasons, will afford him the largest outturn, and price is a secondary consideration. But, between two wheats equal in average outturn, that wheat will generally pay best which best suits the requirements of the British miller, as above summarised.

The problem is so complex that it will be some years before the expert can confidently recommend to the small farmer the varieties which will best stand the vicissitudes of season in each locality and at the same time bring in the best price. Even then, it will be some years before he can persuade any large number of peasant farmers to adopt them. The experts are working on the right lines, and I have every hope that in time their labours will result in a marked improvement in the outturn and quality of Indian wheat. But meanwhile the problem should be attacked on its practical side. I recommend that the Punjab Director of Agriculture should endeavour to form at Lyallpur a co-operative seed-supply association by getting the leading farmers, landowners, and traders to combine. A committee of the more intelligent of them should determine which of the wheats grown in the neighbourhood on the Chenab Canal have been proved by practical experience to give the best average outturn and to command the best price in the local market. They should, at harvest-time, buy large quantities of the purest and most uniform parcels of such wheats they can find, keep them separate, and sell them at seed-time for a price just high enough to cover all costs, including interest, storage, and establishment. Usually this price would not be much above the price of ordinary good wheat at seed-time, and I think a sufficiently large number of intelligent farmers would be found willing to pay a little higher than the market price for good seed. The produce should also be dealt with on a co-operative basis, and endeavour made to sell all the wheat of one type together, so that it may form a parcel large enough to make it worth the while of the middleman and shipper to keep it separate, and deliver it as a uniform parcel of good quality in the London market. The Government is so much interested in improving the value of wheat to the farmer that it might well lend the society any capital it required from time to time at $6\frac{1}{4}$ per cent., the usual rate of interest for Government loans. It would greatly facilitate transactions, if the North-Western Railway would build an elevator where the grain

so collected could be cleaned, graded, and stored. There is plenty of excellent wheat already grown in the Punjab which is almost as good for the British miller's purposes as any in the world, and by such means it might be possible to supply him with large quantities of clean, pure, uniform wheat of good quality, for which he would willingly pay a better price.

Suggestions to British Millers.

But the British buyer must also co-operate, if he wishes to obtain such wheat from India, and I may be pardoned for making some suggestions to the British millers:—

(1) It would greatly simplify matters if discounts were abolished, and all Indian wheat bought on a basis of so much cash on delivery for 480 lbs. net weight of grain, the bags being paid for separately.

(2) It would secure the great improvement already obtained in the cleanliness of Indian wheat, if the penal double rate for dirt were charged for anything over $1\frac{1}{2}$ per cent., instead of the present allowance of $2\frac{1}{4}$ per cent.

(3) So long as buyers are willing to pay a wheat price for 2 per cent. of barley and gram, they will seldom get wheat with a less percentage than this. The present allowance should be abolished, and half price paid for any proportion of grain other than wheat, however small it may be.

(4) Buyers should be more ready to buy specially good parcels on sealed sample, instead of on the basis of "fair average" quality. Until they do so, it will not pay shippers to keep good parcels apart from the ruck.

(5) Red Karachi wheat should be graded in two classes, which might be called No. I red Karachi and No. II red Karachi. Until this is done, good red wheat will simply be mixed with ordinary stuff before shipment. At the same time the names, choice white Delhi and choice white Karachi, might well be changed to No. I white Karachi and No. II white Karachi.

If these changes were carried out, the grower of good Indian wheat would get a better price for his better quality, and the British miller would get a larger quantity of good Indian wheat in clean, pure, uniform condition. At present the United Kingdom secures only a tenth of India's total output of wheat. It

Indian wheat could be obtained in the British market in such condition, its reputation and price would rise, and much larger quantities would find their way to this country to the benefit of all concerned, whether Indian farmer, middleman, shipper, ship-owner, miller, or British consumer. India can grow almost any kind of wheat, and does now grow wheats which can compare with the best in the market. If the British miller will only tell us distinctly what types of wheat he wants, and will pay a higher price for them than for inferior types, so that the Indian farmer will get a higher price for any such wheat he grows, India will produce them for him in much larger quantity than at present.

TABLE I.

Imports of Wheat and Wheat-flour into the United Kingdom (in hundreds of thousands of cwt.).

From	Quantity	AVERAGE OF THREE YEARS ENDING 1902.						AVERAGE OF SEVEN YEARS ENDING 1909.		
		1903.	1904.	1905.	1906.	1907.	1908.	1909.	Quantity.	Per cent. of total imports.
All Countries	1,025	100	1167	1,182	1,142	1,127	1,156	1,092	1,133	1,143
India	41	4	171	255	229	126	183	39	116	163
Russia	46	4	173	237	249	151	109	46	178	163
United States	631	62	409	185	145	361	336	407	251	308
Argentina	105	10	142	218	241	194	220	318	201	219
Canada	96	9	145	90	84	138	150	168	135	139
Australia	43	4	—	114	115	85	85	58	104	80

Note—These figures are taken from the British Trade Statistics, which reckon the quarter at 480 lbs., and allow 28 per cent. of offal as the result of the process of converting grain into flour, *i.e.*, add 30 per cent. to the weight of flour to get the corresponding weight of wheat.

TABLE II.

Exports of Wheat from India by Sea (in hundreds of thousands of cwts.).

	1901-02	1905-06	1906-07	1907-08	1908-09	Average of the five years.	Per cent. of total exports.
Total exports	430	188	160	176	22	195	100
Exports to United Kingdom	289	142	146	154	21	150	77
Exports to all foreign countries	139	44	11	19	1	43	22
Exported from Karachi	254	130	154	169	20	152	78
Exported from Bombay	60	35	5	6	1	21	11
Exported from Calcutta	86	23	1	1	1	22	11

Note.—These figures are taken from the last volume published of Indian Trade Statistics.

TABLE III.

Area and Outturn of Wheat in India and in the Chief Wheat-producing Provinces.

Province.	AREA UNDER WHEAT IN TENS OF THOUSANDS OF ACRES.					ESTIMATED YIELD OF WHEAT IN TENS OF THOUSANDS OF TONS				
	Average of five years ending 1907-08.	AVERAGE OF SEVEN YEARS ENDING 1908-09.				Average of five years ending 1908-09.	AVERAGE OF SEVEN YEARS ENDING 1908-09.			
		1907-08.	1908-09.	Area.	Percentage of all India.		Weight.	Percentage of all India.		
All India	27,17	22,81	25,84	26,36	100	8,76	6,10	7,58	8,18	100
Punjab	8,03	8,27	8,88	8,18	31	3,34	2,49	3,06	3,18	39
United Provinces	7,19	4,41	5,67	6,58	25	2,54	1,67	2,13	2,36	29
Central Provinces and Berar	3,31	2,71	2,78	3,13	12	1,82	1,49	1,69	1,75	9
North-West Frontier Province	97	98	1,02	98	4	28	21	21	26	3
Sind	55	45	53	53	2	16	11	13	15	2

Note.—These figures are compiled from the Final General Memorandum on the Wheat Crop of India for the Season 1908-09.

The figures for the Punjab include those for its Native States.

TABLE IV.

Exports of Wheat from the Punjab, including its Native States and the North-West Frontier Province (in thousands of maunds of $82\frac{1}{2}$ lbs.).

Year ending 31st March.	Total Export of Wheat.	Exported to Karachi.	EXPORTED FROM TERRITORY BETWEEN THE SUTLEJ AND JHELAM RIVERS.		TOTAL EXPORTED TO	Total export of Wheat Flour.
			Total	To Karachi. Calcutta. Bombay.		
1903-04	23,896	21,926	16,325	16,651	9	947
1904-05	32,415	30,966	20,600	20,537	31	943
1905-06	21,121	16,663	12,831	11,821	539	1,374
1906-07	27,565	20,362	19,337	16,566	1,657	1,396
1907-08	30,386	22,511	17,842	15,756	1,292	1,210
1908-09	7,803	4,681	5,228	3,146	1,057	264
Average in thousands of maunds.	23,923	19,518	15,861	14,030	764	1,022
Average in thousands of cwt.	17,583	14,316	11,290	10,312	562	731

Note.—These figures are taken from the Punjab Internal Trade Report.

TABLE V.

Wheat in the 29 British Districts of the Punjab Proper.

Year ending 31st May.	AREA SOWN (TENS OF THOUSANDS OF ACRES).			OUTPUT OF WHEAT (THOUSANDS OF TONS).			PRICE AT HARVEST TIME IN RUPEES PER MAUND OF $82\frac{1}{2}$ LBS.	
	WHEAT.			Total. Irrigated. Un-irrigated.			At Amritsar. At Lyallpur.	
	All Crops.	Total.	Irrigated.	Un-irrigated.	Total.	Irrigated.	Un-irrigated.	At Amritsar.
1902-03	26.24	6.41	3.74	2.68	—	—	—	—
1903-04	28.38	7.82	4.07	3.74	—	—	—	—
1904-05	16.96	7.08	3.96	3.73	—	—	—	—
1905-06	28.14	8.51	4.50	4.02	—	—	—	—
1906-07	29.88	9.05	4.44	5.51	2,631	1,504	1,137	2.25
1907-08	24.53	7.39	4.57	3.02	2,216	1,711	506	3.62
1908-09	29.30	8.40	4.05	4.34	2,895	1,796	1,100	3.25
Average	27.63	7.98	4.16	3.82	2,584	1,673	914	—

Note.—These figures are taken from the Punjab Season and Crop Report. Up to 1905-06 the figures for area under wheat are for matured area only, omitting the area on which the crop was estimated to have failed.

TABLE VI.
Prices of Wheat in the London Market when Choice White Karachi sells at 40s. per Quarter.

Class of Wheat	Quoted price per quarter.	Weight of 480 lbs.	Price of 480 lbs.	Conditions.	Value of Allow- ances per Quarter of 480 Lbs.		Price actually paid by Buyer for Tare or for other Grains of pure Wheat.
					Value of Bags.	Value or Discount.	
Choice White Karachi	40 9	482	39 0	Cost of freight paid by seller.	6 8	—1 3	37 8
Red Karachi	39 4	482	38 4	Net weight, less 2 per cent discount and 60 days interest at 5 per cent, bags given free.	—0 8	+0 5	37 0
Choice White Delhi	40 6	482	39 6	Cost of insurance and freight paid by seller.	—0 8	+0 5	38 2
No. 2 Club, Calcutta	40 9	482	39 9	Net weight, less 2 per cent discount and 60 days interest at 5 per cent, bags given free.	—0 8	+0 5	38 4
No. 1 Club, Bombay	41 2	482	40 2	Cost of insurance and freight paid by seller.	—0 8	+0 5	38 9
Choice White Bombay	41 6	482	40 6	Net weight, less 2 per cent discount and 60 days interest at 5 per cent, bags given free.	—0 8	+0 5	39 1
Hard Red Bombay	38 9	482	37 9	Cost of insurance and freight paid by seller.	—0 8	+0 5	36 5
Average British Wheat	37 0	504	35 3	Cash on delivery.	—	—	35 3
Russian (Black Sea)	39 6	492	38 6	Two per cent. discount. Interest allowed about 75 days at 5 per cent.	—	+1 6	38 10
Argentine Rosed	37 6	680	37 6	Gross weight. No discount. Interest allowed at 60 days at about 5 per cent.	—0 3	+1 1	38 4
United States (White Wheat)	40 0	500	38 5	Gross weight. No dis- count. Interest allowed 60 days at about 3 per cent.	—0 8	+0 5 (free). +0 5 one). —	38 0
Australian (South)	39 6	480	39 0	—	—0 2	—	38 7
Canadian (No. 2, Northern Manitoba),	40 0	480	40 0	—	—0 2	—	39 16

TABLE VII.
Prices of Wheat, -Punjab and England.

Calendar Year.	PUNJAB AVERAGE ANNUAL RETAIL PRICE.		Average Gazette Price in England and Wales of British Wheat, Shillings per Quarter.	Difference between Punjab and English Price. Shillings per Quarter.
	Rupees per Maund.	Shillings per Quarter.		
1901	2.65	21.2	28.8	+5.6
1902	2.52	20.2	28.1	+7.9
1903	2.45	19.6	28.8	+7.2
1904	2.36	18.1	28.3	+10.2
1905	2.07	21.4	29.7	+8.3
1906	2.73	21.8	28.2	+6.4
1907	2.90	23.2	30.6	+7.4
1908	4.19	33.5	32.0	-1.5
1909	3.67	29.4	38.7	+7.3

Note.—For explanation of this table see text.

